A.D. 1885. Aug. 19. N° 9847.
JUSTICE'S COMPLETE SPECIFICATION.

U.S. Pat to Billings 324523. Aug 15 '85

Brit. 9847/1885

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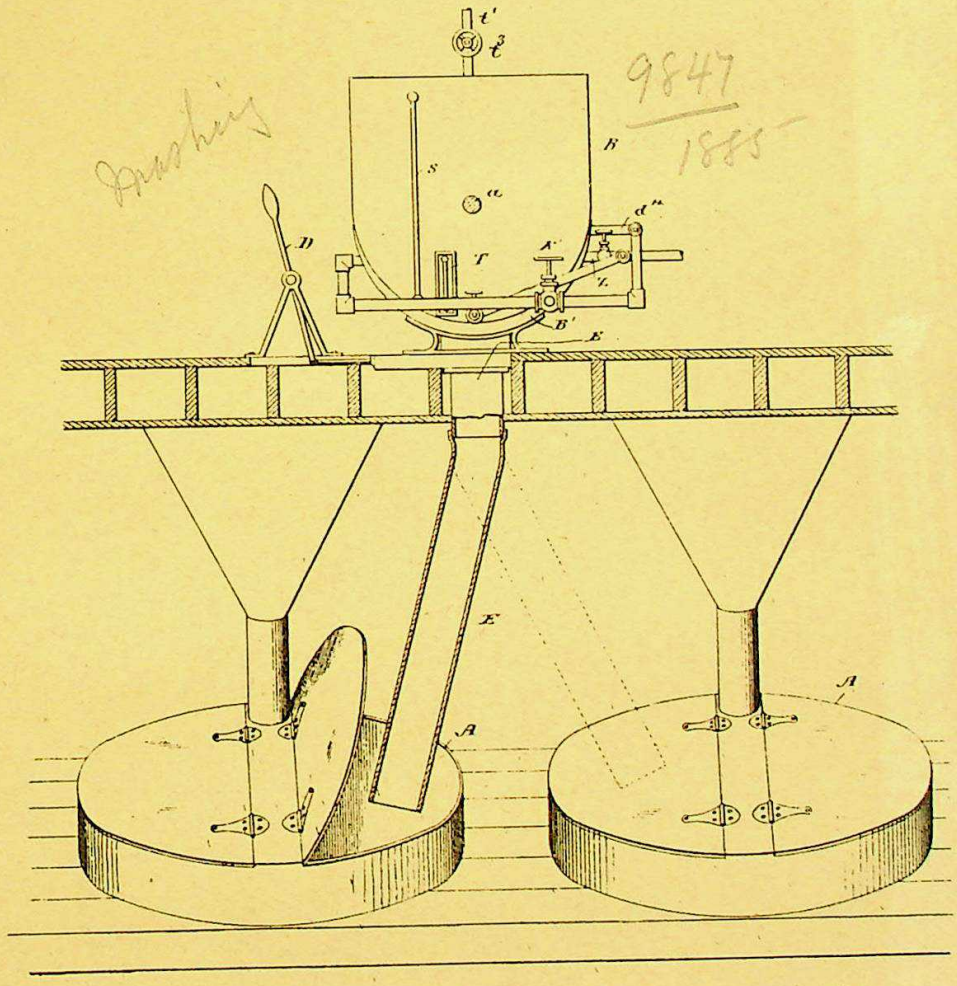
FIG. 1.



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Washing

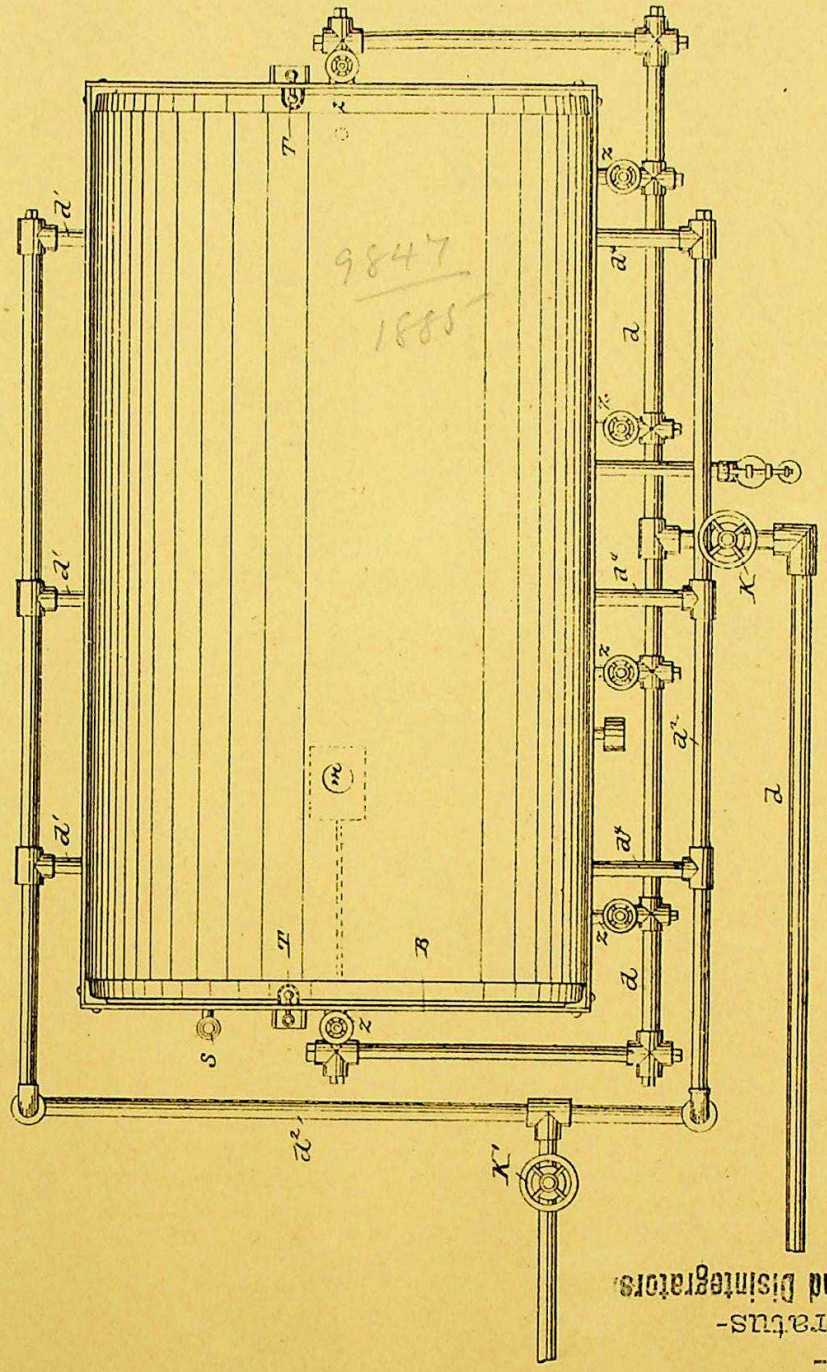

FIG. 2.

ALCOHOL,
Washing-
Apparatus-
Digesters and Disintegrators.

TISWOODE.
Majesty 1885

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FIG. 3.

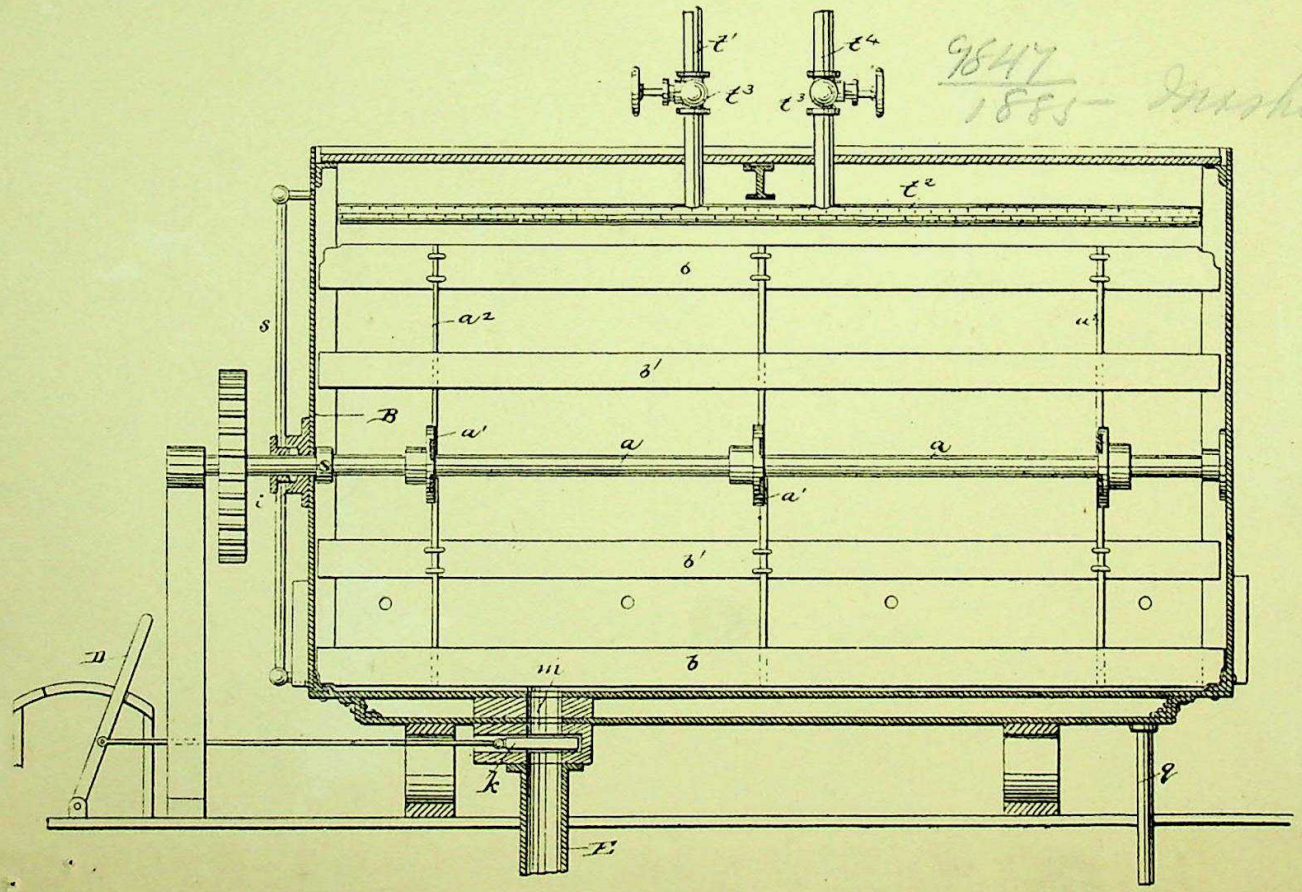


FIG. 4.

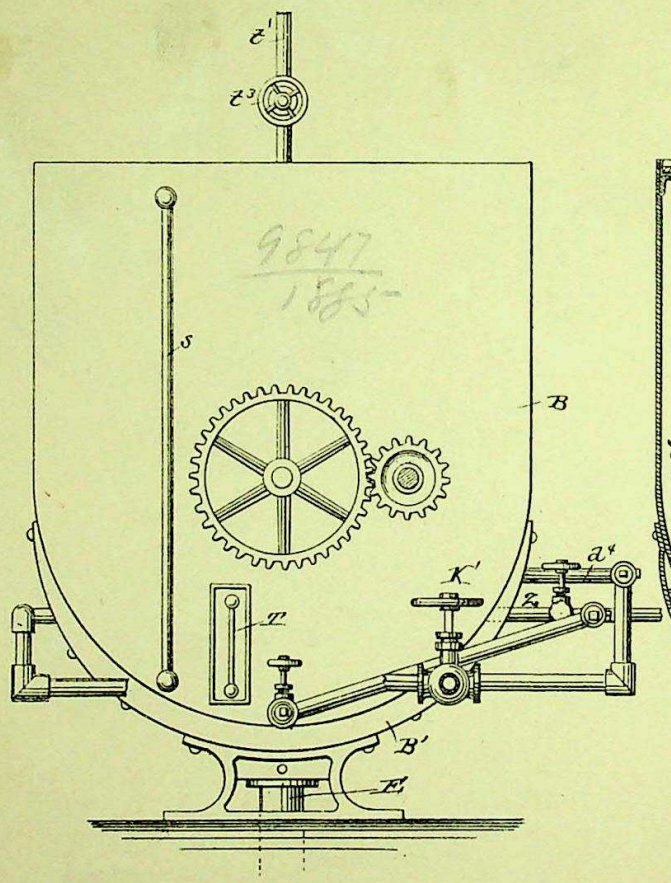
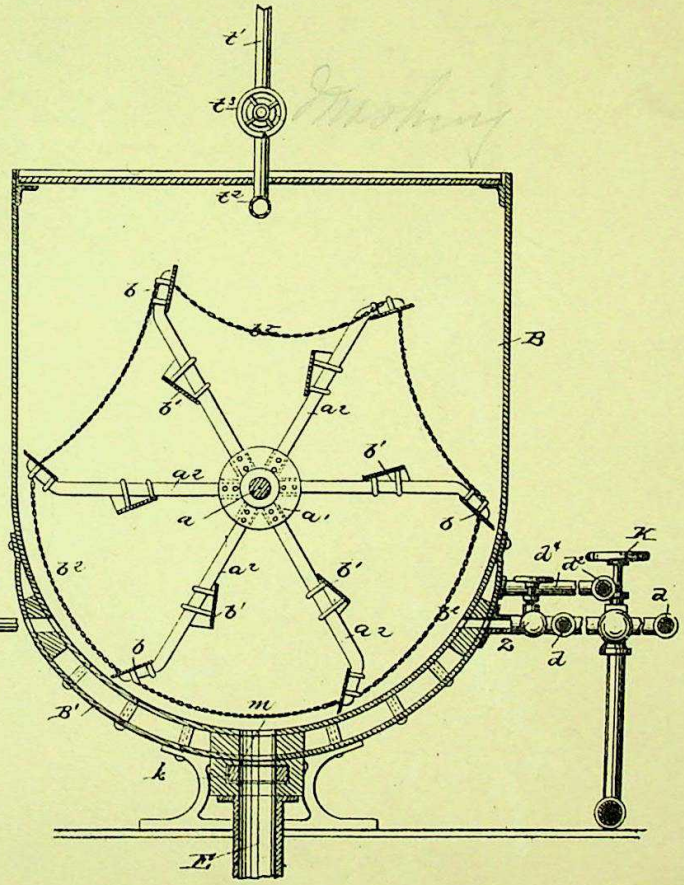


FIG. 5.



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A.D. 1885, 19*th August.* N° 9847.

COMPLETE SPECIFICATION.

[*Communicated from abroad by Andrew W. Billings, of Brooklyn, Kings County, New York, United States of America.*]

Improvements in the Manufacture of Beer.

I PHILIP MIDDLETON JUSTICE of 55 and 56 Chancery Lane in the County of Middlesex Fellow of the Institute of Patent Agents do hereby declare the nature of the said invention for IMPROVEMENTS IN THE MANUFACTURE OF BEER, a communication to me from abroad by Andrew W Billings of Brooklyn Kings County New York United States of America and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This Invention relates to an improvement in the manufacture of beer or ale, whereby the quantity of malt required is reduced; a superior beer or ale produced without the use of chemicals or other injurious ingredients, and with but little, if any increase of time over that required for the ordinary process, and at a great saving in labour and expense In carrying out the process, there are made, (preferably at the same time) two mashes, one of malt in the ordinary manner using the ordinary apparatus, and the other or supplemental mash of Indian Corn, rice or any other kind of raw grain, using an apparatus, one form of which is illustrated in the accompanying drawings in perspective in Fig. 1; in plan in Fig. 2; in longitudinal section in Fig. 3; in end view in Fig. 4; and in transverse sectional elevation in Fig. 5 The raw grain for the supplemental mash is preferably ground or crushed sufficiently fine for the particles to become thoroughly saturated or wet, and about one bushel of the same so ground or crushed is used as an equivalent for from 2 to 3 bushels of malt as employed in making the malt mash the relative proportions varying with circumstances. The raw grain, ground or crushed as stated is then put in with the requisite quantity of water at the temperature of about 112° Fahrenheit, the stirrers being in motion; then by the injection of live steam directly into the mash, the mash is heated to about 210°, bringing it to a thick pasty condition, care being taken to avoid boiling (the starch cells in the raw grain being thoroughly developed) and then, the steam being shut off, cold water is injected directly into the mash and its temperature thereby quickly reduced to about 140°, when about 4 ounces of malt (preferably ground or

crushed) to every pound of raw grain used, are added and thoroughly mixed through the mash. The operation is at this stage suspended for from one and a half to two and a half hours, so as to allow the diastase which acts on the starch cells, to convert the starch into sugar, the mash then losing its pasty condition, after which the stirrers are again set in motion the mash again heated up to about 185° by the injection of live steam as before, to complete the developement and saccharification of any starch yet unconverted, then the steam is shut off, the flues opened, and the temperature of the mash reduced to that of the malt mash which has meanwhile been prepared whereupon the two mashes are run together, and the subsequent operations are then pursued as in the ordinary brewing.

In the preparation of the raw mash all the malt used as a diastase may be put in at the same time with the raw grain, or there may be a smaller proportion of the malt put in with the raw grain and a second and larger proportion when the mash has been cooled down to about 140°, it is preferable however to put the malt in after cooling the mash down to about 140°, as by doing so, the diastase has its full effect and its virtues are not destroyed by the temperature of the mash.

This mode effects the most complete conversion, gains the largest amount of extract without producing alcohol or developing any of the salts or acids so injurious to yeast and beer and without setting free the oils thereby avoiding any corn like flavour or smell, but the desired results may be secured by preparing the mash in other ways. In the preparation of the raw mash, the heating and cooling may be effected in different ways, the best results ensue by heating by injecting live steam directly into the mash, and by cooling, by adding cold water for by these means all loss of time is avoided, far less steam is used, and the entire series of operations (except for the saccharificating) requires but a few minutes. By thus preparing two mashes, making the raw mash so as to thoroughly extract the saccharine matter, and then mixing the two, and pursuing the ordinary brewing operations, it is possible to substitute a large percentage of raw corn or other grain for the malt otherwise required, with a corresponding saving in expense as the two mashes are simultaneously prepared there is no loss of time and the product thus obtained is very desirable, of pure quality, bright, very light golden colour without any green tinge, possesses a most agreeable flavour, without any corn taste whatever and will keep sound for a longer time than the products of ordinary processes: Preparing two mashes also avoids delays expense and liability of injurious effects which would result from treating the entire mass of worts, for it will be seen that a small proportion of the material may be raised and lowered in temperature and otherwise treated much more readily than if the raw grain was introduced into the entire mass of liquor and like operations pursued. As before stated care must be taken to avoid boiling, as a low temperature will suffice to develope the starch which is all that is required while a slightly higher temperature will cause the mass to be converted into a mash that would not draw off or filter, and will also result in the extraction of oils &c, which would not only injure the flavour of the product but would cause the wort to afterwards ferment and injure the quality and interfere with the production of the beer.

This is especially the case where raw, crushed or unbolted grain is used as is done in carrying out my process. Boiling or heating under pressure also results in the extraction of oils &c, and formation of alcohol so that the wort is not clear and is liable to become whey, and injure the product.

In the apparatus shown in the drawing A. is the ordinary mash tub, in general use, upon one floor, and B. the supplemental mash tub, preferably in a higher position. The raw grain mash is made in the upper tub, the malt mash in the lower, and at the proper time the upper mash is transferred to the lower. The tub B is preferably of iron, with a curved bottom, and with an outer jacket B^1 forming a steam chamber.

The tub B is crossed by a shaft *a*. carrying hubs a^1 from which radiate arms a^2 supporting stirrer blades b b^1 which serve to keep the mash in agitation. The steam is injected from a steam pipe *d* through pipes or nozzles *z* at the sides and

ends so as to be brought in direct contact with the whole body of the mash at once, a valve K controlling the flow of steam to all the nozzles and the stirrers are rotated so as to aid in carrying the steam downward from the inlet pipes into and through the body of the mash. Each branch z is provided with a valve arranged as close to the side of the tub as possible, so as to have no room for a deposit which would close the opening, and the angles of the steam pipe d. are provided with suitable caps or plugs so arranged that they are readily removed, and afford complete access to the pipes for the purpose of removing any obstruction or thoroughly cleaning when necessary. The discharge valve k, at the outlet m is arranged close to the tub.

A lever D operates the valve k, and a pipe E conducts the mash from the tub B to the tub A. The steam chamber is supplied with steam through a pipe d^2 provided with branches d^1 d^4, a cock K^1 controlling the flow of steam to all the branches. This jacket is auxilliary to the live steam injected directly into the mash and aids in regulating the temperature, and in that rapid heating of the mash which is so essential in carrying out my improved process. The blades b are set to move as near the bottom of the tub as possible, and at an angle to the supporting arms so as to tend to lift the material from the bottom, prevent it baking thereon, and throw it towards the centre of the tub thereby overcoming the tendency when the agitator is revolving at a high speed, to throw the mash out of the tub. The inner blades b^1 are set in the opposite direction to the blades b, thereby creating counter currents which aid in thoroughly mixing the mash. To further agitate the mash and thoroughly cleanse the bottom of the tank, chains b^3 are suspended between the blades b as shown, these chains scraping the bottom and breaking up the material The even distribution and proper temperature of the water thrown into the mash is secured by the use of a perforated distributing pipe t^2 arranged beneath the cover or lid, and communicating with the cold water pipe t^4 and hot water pipe t^1 each pipe t^1 t^4 having a cock t^3 so that either cold or hot water or water of any desired temperature may be thrown evenly over the surface of the mash. This even distribution is important, as the sudden injection of water at one or more isolated points only would affect only part of the mash and lead to deleterious changes.

Thermometers T are arranged at suitable points in the tub B to enable the temperature of the mash to be ascertained and properly regulated. The injection of the live steam directly into the mash not only quickly heats it but aids to maintain it in agitation, prevents its baking to the tub and effects the requisite changes more promptly and with better results than when steam pipes or casings are employed.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, as communicated to me by my foreign correspondent I declare that what I claim is

1. The improvement in the manufacture of beer or ale, the same consisting in making a malt mash making also a mash from raw grain by heating to a temperature below the boiling point, to secure the starch without extracting the oils and adding malt, and then mixing the two mashes and treating as is usual in beer and ale making substantially as described.

2. In the manufacture of beer or ale, making a mash of corn rice or other raw grain, by combining the raw grain with warm water, raising the temperature by the direct injection of live steam to nearly the boiling point; cooling suddenly by the direct injection of cold water, then adding a small proportion of malt, and after the mash has been allowed to stand, again heating by the injection of live steam substantially as described.

3. In the manufacture of beer or ale, making a corn mash by combining the corn, a small proportion of malt, and warm water, raising the temperature to nearly the boiling point, but without extracting the oils; cooling; and after the mash has been allowed to stand, again heating, substantially as described.

4. In the manufacture of beer or ale, making a corn mash containing a proportion of malt, and alternately heating and cooling the mash substantially as and to the degrees herein set forth, and combining with a malt mash, as described.

5. In the manufacture of ale or beer, heating and cooling the raw grain mash by the direct injection of live steam and cold water, to raise the temperature nearly to the boiling point, and suddenly lower it, to thoroughly convert the starch, but prevent the extraction of oils and other matters substantially as and for the purposes set forth.

6. In the process of making ale or beer, treating and mashing raw grain, to remove the starch without extracting the oils, adding diastase, and combining the mash thus made with mash made from malt, and treating the two together as usual in beer or ale making, substantially as described.

7. The combination with the usual open mash tub A. of a supplemental mash tub, adapted to hold a supplemental mash, and provided with means for agitating and alternately heating and cooling said supplemental mash, and with conduit to the tub A. substantially as set forth.

8. The combination of the open mash tub A. supplemental mash tub B, steam pipes provided with valves having branches communicating therewith, cold water pipe, agitator, and discharge pipe provided with a valve and leading to the main mash tub, substantially as described.

9. The combination with the tub agitator and steam pipe and branches admitting steam directly into the tub, of a steam jacket at the bottom of the tub, substantially as described.

10. The combination with the tub and its steam jacket, of an agitator, consisting of a shaft, arms, and blades b, set at an angle to the arms, substantially as described.

11. The combination of the tub, shaft, arms, blades b, and blades b^1, set at an angle to the blades b substantially as described.

12. The combination of the tub shaft, arms, blades, and chains b^2 substantially as, and for the purpose described.

13. The combination of the tub agitator, steam inlet pipe and perforated pipe t^2, cold and hot water pipes t^1 t^4, communicating with the pipe t^2 and provided with cocks, substantially as described.

Dated this nineteenth day of August 1885.

PHILIP M. JUSTICE.

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crushed) to every pound of raw grain used, are added and thoroughly mixed through the mash. The operation is at this stage suspended for from one and a half to two and a half hours, so as to allow the diastase which acts on the starch cells, to convert the starch into sugar, the mash then losing its pasty condition, after which the stirrers are again set in motion the mash again heated up to about 185° by the injection of live steam as before, to complete the developement and saccharification of any starch yet unconverted, then the steam is shut off, the flues opened, and the temperature of the mash reduced to that of the malt mash which has meanwhile been prepared whereupon the two mashes are run together, and the subsequent operations are then pursued as in the ordinary brewing.

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Justice's Improvements in the Manufacture of Beer.

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